Ultra-Long Duration Balloon
Flight Software
Product Plan

Version 4.0
February 18, 2000

ULDB Flight Software Product Plan

Revision 4.0

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Product Development Handbook Revision D dated 09/01/99

1.0 Introduction

This document is intended to describe the plan for the development of the Ultra-Long Duration Balloon (ULDB) Flight Software. This document shall be the basis for formal agreements between the Balloon Programs Office and the ULDB Flight Software development team.

1.1 Purpose

This document is intended to describe the plan for the development of the Ultra-Long Duration Balloon (ULDB) Flight Software. This document shall be the basis for formal agreements between the Balloon Programs Office and the ULDB Flight Software development team.

1.2 Background

Recent advances in composite super-pressure balloon materials have greatly enhanced the prospects for very long duration balloon flights on Earth as well as possible use for planetary exploration. NASA is embarking on the development of technologies to support extended balloon missions lasting up to 100 days (~5 circumnavigations of the globe) above 99.9% of Earth's atmosphere.

The ULDB objective is to develop a low cost, integrated, advanced, long duration balloon system which is technically feasible and within program cost constraints while maintaining the existing balloon program. The ULDB program is significantly different from the current balloon program in that the expected science return is significantly greater than current balloon missions. In other words, it is more than simply extending current experiments over a longer time period. This program also expects to use technologies currently available in the spacecraft missions and commercial arenas to improve performance while containing costs.

The purpose of the ULDB flight software effort is to process, monitor, and control data received and collected on the airborne instrumentation package. The flight software will facilitate all communications with the instruments on board and to the ground through continuous line of sight and over the horizon communications.

1.3 Product Plan Review and Update

The ULDB Project Manager and the ULDB Balloncraft Project Manager will review this document.

This document has been developed by and shall be maintained by the ULDB Flight Software team, as defined in section 3.3. It may be updated to reflect changes in the project objectives. The ULDB Flight Software Product Design Lead (PDL), the Code 584 Branch Head, and the ULDB Control Center Software Lead have to approve any changes made to this document.

2.0 Customer Agreement

This section describes the agreement between the ULDB Flight Software customer and the ULDB Flight Software development team including those issues related to requirements, deliverables, and maintenance.

2.1 Customer Identification

The primary customer for the products developed by this effort is the Balloon Programs Office. The project has relevancy to the Earth Science Enterprise and the Space Science Enterprise as defined in NASA's strategic plan.

2.2 Customer Goals and Objectives

The customer's objective with respect to the ULDB Flight Software is to be provided with software that processes, monitors, and controls data received and collected on the airborne instrumentation package. The flight software will facilitate all communications with the instruments on board and to the ground through continuous line of sight and over the horizon communications.

2.3 Requirements

For a detailed description of the functional requirements refer to the ULDB Flight Software Requirements and Functional Specifications document linked to the ULDB Flight Software web page at http://www.wff.nasa.gov/~code584/ULDBFlightSoftware/documentation.html.

The parent document to the ULDB Flight Software Requirements and Functional Specifications document is the Design-To Requirements Document (DTRD), 820-ULDB-DTRD-002.0, 10/16/98. This document is linked to the ULDB web page at http://www.wff.nasa.gov/~code584/ULDBFlightSoftware/documentation.html.

2.4 Deliverables

The products to be delivered by the conclusion of this project include the flight software, supporting documentation, including design documentation, user's guides, and maintenance guides.

2.5 Necessary Customer Training

The customer will receive training related to system installation and software diagnostics.

2.6 Medium for Product Delivery

Commercial Off-the-Shelf (COTS) incorporated into the product shall be delivered to the appropriate destination(s) as they are delivered from the vendor. The flight software shall be installed on the flight computer for delivery by means of a network connection. A copy shall also be delivered on a floppy disk.

2.7 Product Destination

The flight software will be installed on the ULDB flight computers.

2.8 Post Delivery Maintenance

Maintenance of the ULDB Flight Software will be the responsibility of the ULDB Flight Software development team. All modifications to the ULDB Flight Software needed to address bug fixes, enhancements, and upgrades will be performed by or managed by the ULDB Flight Software team. Post Delivery Maintenance may be requested by filling out a "Request For Support" form (RFS) available from Code 584. Requested changes will be reviewed and must be approved by the customer and development team before they are implemented. Requests will be documented, saved, and kept as Quality Records.

2.9 Customer Supplied Elements

This section describes those elements of the ULDB Flight Software development effort that are to be supplied by the customer.

2.9.1 Funding

The customer shall provide all funding necessary to complete the project. This includes funding for all hardware, software, personnel, and facility equipment required for the project. A budget for the effort has been compiled and is available upon request from the ULDB Flight Software PDL.

2.9.2 Test Environment

The customer shall provide one or more flight computers as a test bed for the integration, test, and verification of the flight software. Other Code 500 ULDB PDL's will make their subsystems available for testing of the flight software as it interfaces with their subsystem. The test bed will exercise, to the greatest extent possible, all of the data acquisition, processing, handling, commanding, and analysis.

2.10 Customer Involvement

The customer shall be the primary point of contact for the development of a concise list of requirements and functional specifications. Throughout the development of the flight software the customer will continue to serve as a point of contact for questions regarding detailed requirements and operation concepts. The customer shall review all documentation, including requirements and design reports. Significant documents related to customer agreements will be maintained as Quality Records.

2.10.1 ULDB Project Manager

Steve Smith, Code 820 (Ira.S.Smith.1@gsfc.nasa.gov)
The ULDB Project Manager is responsible for establishing the requirements to be met by the effort. In addition, it is the Project Manager who has final authority over the acceptability of the deliverable and will approve of change in scope, acceptability of levels of risk, and modifications to schedule.

2.10.2 ULDB Balloon-craft Manager

David W. Stuchlik, 822 (David.W.Stuchlik.1@gsfc.nasa.gov)
The ULDB Balloon-craft Manager is the primary point of contact for specific technical issues regarding the ULDB balloon-craft. The Balloon-craft Manager provides guidance with respect to the specific technical performance of the new system against the requirements specified by the ULDB Project Manager.

2.11 Customer Communications

Communication with the customer will be carried out in a variety of forms. The ULDB Flight Software PDL will make regular contact with the customer in order to report status, bring up development issues, and discuss design decisions. A report describing the project status, recent accomplishments, near-term plans, and problems encountered will be delivered to the customer at the end of each month. Status reports will serve as quality records for reviews and will be maintained by the Quality Records Custodian.

2.12 Authority for Changes

All changes to the requirements for the project required or requested by the customer should be forwarded to the ULDB Flight Software development team in writing. Electronic forwarding of requirements changes via e-mail is preferred. If changes in requirements will result in a change in the flight software development schedule, the customer will be informed of the estimated impact promptly.

All changes to the design or implementation of the project required or requested by the ULDB Flight Software development team that may have schedule impacts will be forwarded to the customer in writing.

Written authorization for or concurrence with the proposed changed by the customer will be required and the documents kept as Quality Records.

2.13 Acceptance Criteria

The product will be determined to be complete when the customer accepts it. The PDL will provide supporting evidence of the product's readiness. The development team has created a verification checklist and the development team will complete this checklist during the project integration and test period. This checklist, the Test and Verification Matrix, is linked to the ULDB Flight Software web page at http://www.wff.nasa.gov/~code584/ULDBFlightSoftware/documentation.html. A demonstration of the flight software will be performed during integration and test. This demonstration will exercise all features of the system that correspond to the documented system requirements.

Upon fulfillment of the test plan and verification checklist a formal release form, with a uniquely assigned number, will be signed by the ULDB Flight Software development team, the ULDB Project Lead, and the ULDB Balloon-craft Manager. The release notice will become a part of the project's quality records.

2.14 Customer Agreement Review and Update Process

Either the customer or the ULDB Flight Software Team may initiate changes to the requirements. All changes must be requested using the ULDB Flight Software Request for Change form found on the ULDB Flight Software web page at http://www.wff.nasa.gov/~code584/ULDBFlightSoftware/documentation.html. Requested changes will be reviewed and must be approved by both the customer and the development team before they are implemented. A database will be created to track the requested changes. The signed Request for Change forms will be preserved by the development team and kept as Quality Records.

3.0 Management Approach

This section describes the management approach that will be employed in the ULDB Flight Software development effort.

3.1 General Development Approach

The general development approach of the ULDB Flight Software will use Commercial Off-the-Shelf (COTS) operating system and Government Off-the-Shelf (GOTS) products. Specifically, products that have been successfully employed for similar projects for code building will be evaluated and reused for this effort.

The design, fabrication, and testing of a PC-104 interface for the TDRSS transceiver (the TDRSS Data Interface) will be a part of the ULDB Flight Software development effort.

3.2 Resources Needed

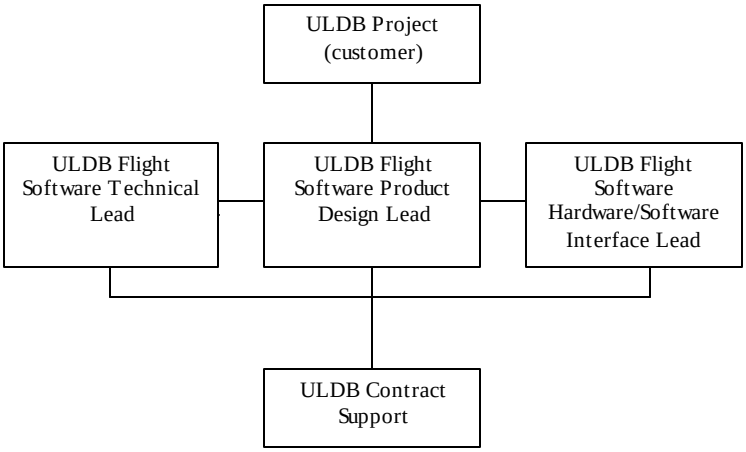
The development of the ULDB Flight Software will include three NASA employees for a total of 2.3 FTE and will be supported by the RTSEB. Contractor support for software development will also be provided at 3.0 FTE. These resources are formally requested and described in the Code 584 Statement of Work, number 820024.

3.3 Team Organization

This section describes the organization and purpose of the ULDB Flight Software development team.

3.3.1 Team Organization Chart

The following chart depicts the organization of the ULDB Flight Software development team.



3.3.2 Team Charter

The ULDB Flight Software development team will provide ULDB flight software to process, monitor, and control data received and collected on the airborne instrumentation package. The flight software will

facilitate all communications with the instruments on board and to the ground through continuous line of sight and over the horizon communications.

3.3.3 Team Scope

The ULDB Flight Software development team will procure and/or develop all hardware and software necessary for the ULDB Flight software and TDRSS Data Interface.

3.3.4 Roles, Responsibilities, Authority, Accountability

This section describes the roles and responsibilities of the members and supporting organizations associated with the ULDB Flight Software development. Specific duties are assigned to team members via the development schedule found on-line at:
http://www.wff.nasa.gov/~code584/ULDBFlightSoftware/documentation.html.

3.3.4.1 ULDB Flight Software Product Design Lead/Developer

Roger F. Mason, Code 584W (Roger.F.Mason.1@gsfc.nasa.gov)
The ULDB Flight Software Product Design Lead (PDL), Developer, and Quality Records Coordinator and Custodian is responsible for the administration, manpower staffing, product documentation, status reports as required, and demonstrations of progress, as well as participating in the design, development, testing, and deployment of the flight software.

3.3.4.2 ULDB Flight Software Technical Lead/Developer

Rodney A. Davis, Code 584W (Rodney.A.Davis.1@gsfc.nasa.gov)
The ULDB Flight Software Technical Lead/Developer is responsible for the design, development, testing, and deployment of the flight software.

3.3.4.3 ULDB Flight Software Hardware/Softwar e Interface Engineer

Dwayne R. Morgan, Code 584W (Dwayne.R.Morgan.1@gsfc.nasa.gov)
The ULDB Flight Software Developer is responsible for supporting the ULDB Flight Software Lead in the documentation of requirements, definition of interfaces, testing, and deployment of the software. In addition, the ULDB Flight Software Hardware/Software Interface Engineer may provide documentation of the product, status reports as required, and demonstrations of progress as available.

3.3.4.4 Real Time Software Engineering Branch

Code 584W
The Real Time Software Engineering Branch, as the AETD provider of engineering support for this project will provide organizational support for all aspects of the development effort. This support may include generalized development tools and development environments, documentation support, development computers, related training if available within the branch, augmentation of effort levels as required for development, internal reviews or audits, and software development standards and policies.

3.3.5 Decision Making and Conflict Resolution Process

Design decisions related to the ULDB Flight Software system will be made by all members of the development team. In the event of a conflict, the ULDB Flight Software PDL will have the final decision making authority.

3.3.6 External Support

Contractor support has been obtained to supplement the design and development phases of the project. Specific duties are assigned to team members via the development schedule found on-line at: http://www.wff.nasa.gov/~code584/ULDBFlightSoftware/documentation.html.

3.4 Team Interfaces

The ULDB Flight Software development team will interface with the ULDB Control Center development team. An Interface Control Document defining the data and command interfaces between the control center and the flight computers will be generated and approved by each team.

3.5 Development Facilities

The ULDB Flight Software will be developed at Wallops Flight Facility in building N-161. Development will be conducted in both the N-161 lab and in at least one of the offices.

3.5.1 Modifications of Existing Facilities and Schedules

No modifications to the facilities will be required for this effort.

3.5.2 Development of New Facilities and Schedules

No new facilities will be required for this effort.

3.5.3 Physical Security

The N-161 lab is a secured room. Offices in N-161 remain locked when not in use. All government computers are password protected and on a government owned network.

3.6 Procurement

This section describes the purchases planned for the project.

3.6.1 Procurement Needs and Dates

Description	Purchase Date
Wind River Systems VxWorks operating system w/VMI memory option	January 15, 1999
SBS Avionics PASS-1000 1553B Bus Simulator w/PCMIA card	March 15, 1999

3.6.2 Reference Procurement Process

Center wide processes will be used for all procurements. Purchases of hardware and/or software costing more than $2500.00 will be accomplished using the Small Purchases System (SPS). Purchases of hardware and/or software costing less than $2500.00 will be accomplished as a credit card purchase by an approved government credit card holder. All purchases will be compliant with Federal Acquisition Regulations.

3.7 Team Training Plan

Training in the use of VxWorks and the Pass-1000 for the ULDB Flight Software developers will be obtained.

3.8 Risk Mitigation

There are a number of risk factors associated with this effort. Management of these risks is the responsibility of the ULDB Flight Software PDL in conjunction with the other members of the implementation team. The major risk is the schedule. The schedule for delivery of the ULDB Flight Software system is aggressive. Mitigation of risk is anticipated by the use of off-the-shelf software and by

the development team's drawing on the experience of LDB personnel. Reviews and status reports also mitigate risk.

3.9 Schedule

The ULDB Flight Software and TDRSS Data Interface development schedules showing the key steps and milestones associated with the development effort are included on the ULDB Flight Software web page at http://www.wff.nasa.gov/~code584/ULDBFlightSoftware/documentation.html.

3.10 List of Controlled Documentation

The list of controlled documents related to the ULDB Flight Software development effort will be available on the ULDB Flight Software web page at http://www.wff.nasa.gov/~code584/ULDBFlightSoftware/documentation.html.

3.11 Process for Process and Product Metric Analysis

Metrics will be collected as defined in the ISC Product Development Handbook (580-PG-8730.3.1), Appendix E. Analysis of the collected metrics will follow the ISC standard assessment process for process improvement, lessons learned, and for preventative methods to be employed in the life of the system.

The process of the ULDB Flight Software development effort will be analyzed through regular reviews of the schedule, budget, and status of the subsystem. Peer reviews and project reviews are anticipated. The product will be reviewed during formal testing. An Acceptance Test Plan for the effort is being developed and will be published on the ULDB Flight Software web page at http://www.wff.nasa.gov/~code584/ULDBFlightSoftware/uldbflightsoftware.html.

The schedule will be updated monthly; a log will be maintained to record descriptions and justifications for changes to the schedule. Non-conformance reports will include a description, reason, and priority of the reported non-conformance. All system changes will be described and justified in a release notice. Release notices will be maintained by the Quality Records Custodian and kept as Quality Records.

4.0 Technical Approach

This section describes the technical approach that will be used to develop the ULDB Flight Software.

4.1 Software Development Plan

The approach to the development of the ULDB Flight Software will be to maximize the use of Commercial Off-the-Shelf (COTS) products as much as is feasible. Some legacy LDB systems and/or algorithms will be integrated into the new ULDB Flight Software if possible. Incorporation of LDB flight software code is not possible, since the ULDB will use a different operating system and programming language.

4.1.1 Major Activities

This section describes the major activities planned in the development of the ULDB Flight Software. Several phases and products of the effort have been identified. For more information see the ULDB Flight Software development schedules which are included on the ULDB Flight Software web page at http://www.wff.nasa.gov/~code584/ULDBFlightSoftware/documentation.html.

4.1.1.1 Phases

The development of the ULDB Flight Software will include the following phases: Requirements, Design, Development, and Integration and Test. Detailed requirements for all elements of the ULDB Flight Software will be gathered during the Requirements phase. The design of the system will be developed in the Design phase. Purchase requests for all hardware and software needed to support the ULDB Flight Software development will be issued during the Design phase. The Development phase will include all ULDB Flight Software development. During Integration and Test, the ULDB Flight Software will be integrated with other ULDB subsystems and tested against the requirements.

The Development Phase of the Flight Software will occur in a maximum of four builds. Build 1 will include the development of the software libraries required, the main control process, the science and backup computer I/O process, the command handling process, and some data acquisition functionality. Testing and verification of those processes will be included in this phase. Build 2 will continue the development of those processes associated with data acquisition, balloon control, and data logging. Build3 will include the development of all other processes required for the flight software. It will involve the development of the LOS, INMARSAT, and TDRSS Data Interface processes. Build 4 is reserved for required modifications to the software that are identified during the test and implementation of the first three phases.

4.1.1.2 Products Associated with Phases

The Requirements phase will be completed when the Requirements and Functional Specifications document is completed and accepted.

The Design phase will be completed when the Critical Design Review has been presented and the design accepted.

The Development phase will be completed when the hardware and software needed for the project has been obtained, and all software is developed and integrated into a system that satisfies all requirements that can be tested with other ULDB subsystems.

The Integration and Test phase will be completed when the ULDB Flight Software Test and Verification Matrix checklist has been completed, the Acceptance Test Plan has been implemented, and a release form has been signed by the customer and the ULDB Flight Software development team.

4.1.2 Development Methodology

This section describes the methodology that will be employed in the development of this product.

4.1.2.1 Methodology

The ULDB Flight Software will be developed using the waterfall methodology. The product will be delivered in several builds. Periodic peer reviews will be conducted to verify the design. Prototyping will be used to verify that the design meets project requirements.

4.1.2.2 Development Environment

The Wind River Tornado Development Environment for VxWorks running on a PC using the Windows NT operating system will be used to develop the ULDB flight code.

4.1.2.3 Utilized Standards

Data downlinked by the flight software will conform to the Consultative Committee for Space Data Systems (CCSDS) format.

4.1.2.4 Utilized COTS Products and Tools

Software development tools such as SBS Avionics Technologies PASS-1000 1553 bus simulator and the Wind River Systems Tornado development environment for the VxWorks real time operating system will aid in development.

4.1.2.5 Build Strategy

The system will be built and released in several builds. Each phase will provide significant functional capability. The build plan is reflected in the Flight Software Development Schedule available at http://www.wff.nasa.gov/~code584/ULDBFlightSoftware/documentation.html.

4.1.2.6 Product Inspection and Test Approach

Each component submitted or procured for integration into the ULDB Flight Software will be subjected to standard verification and validation procedures to insure compliance with security and year 2000 requirements.

All software elements developed specifically for the ULDB Flight Software effort will undergo an internal Code 584 peer walkthrough. Results of the walkthrough will be a quality record.

Unit testing of each module will be the role of the ULDB Flight Software development team. Modules will be tested against documented ULDB Flight Software requirements.

A Flight Software Test Plan will be available on the ULDB Flight Software web page at http://www.wff.nasa.gov/~code584/ULDBFlightSoftware/documentation.html. The ULDB Flight Software development team will provide supporting evidence of the product's readiness for acceptance. The development team has created a verification checklist and the development team will complete this checklist during the project integration and test period. This checklist, the Test and Verification Matrix, is linked to the ULDB Flight Software web page at http://www.wff.nasa.gov/~code584/ULDBFlightSoftware/documentation.html. A demonstration of the flight software will be performed during integration and test. This demonstration will exercise all features of the system that correspond to the documented system requirements.

4.1.2.7 Acceptance Criteria and Objectives

The development team has created a verification checklist. The development team will complete this checklist during the project integration and test period. This checklist, the Test and Verification Matrix, is linked to the ULDB Flight Software web page at http://www.wff.nasa.gov/~code584/ULDBFlightSoftware/documentation.html.

4.1.2.8 Reviews Planned

The key components of the review cycle include a requirements analysis, to be performed and documented by the development organization, preliminary and critical design reviews, peer reviews, status review, and a system readiness review. The ULDB Flight Software PDL schedules peer reviews, while the ULDB Balloncraft Manager schedules all other reviews. Reviews are noted on the schedule and documentation resulting from reviews kept as Quality Records.

4.1.2.8.1 Requirements Analysis

The requirements analysis will identify project requirements and assess their completeness, clarity and correctness. The product of this analysis will be the ULDB Flight Software Requirements and Functional Specifications document. This document will be reviewed and signed by the ULDB PDL, the ULDB Systems Engineer and Balloon-craft Manager, the ULDB Mission and Operations Manager, the ULDB Control Center development team, and the ULDB Flight Software development team.

4.1.2.8.2 Design Reviews

Preliminary and Critical design reviews will assess the applicability of the specific system design and implementation plan. These reviews will provide an external view of the development effort and will insure that the implementation strategies and designs make maximum use and reuse of COTS and other off-the-shelf systems or technologies and minimize risks associated with the effort. The review panel will be made up of individuals selected by the Balloon Projects Office.

4.1.2.8.3 Status Reviews

Status reviews will be held as required by the project and will provide both project and management personnel with a current status of all aspects of the project. Each review will identify areas of progress, areas of completion, areas of lag, and changes to requirements, schedule, budget, or functionality to be delivered. The review panel will be made up of individuals selected by the Balloon Projects Office.

4.1.2.8.4 System Readiness Review

The System Readiness review will establish that the system design and implementation has met the requirements and can be released for operational use. The review panel will be made up of individuals selected by the Balloon Projects Office.

4.1.3 Incoming Inspection and Test

No inspection other than kind, count, and condition of purchased products is planned.

4.1.4 Control of Test Equipment

Test equipment will be used in integration and test of the TDRSS Data Interface. Control of the test equipment will be the responsibility of the project providing the test equipment.

The PASS_1000 1553B software simulator test software from SBS Avionics will be used in the development of the flight software. The WindView debugging software for VxWorks from Wind River Systems will be used for debugging the flight software.

4.2 Process for Transportation, Identification, and Medium of Product

The NASA/GSFC center process for transportation will be used to transport all ULDB Flight Software products. Each software release will have a unique version number for identification. The medium for product delivery was discussed in section 2.6.

4.3 Technology and Commercialization Plan

There is no technology and commercialization plan at this time.

4.4 Servicing – Process for Product Maintenance

Servicing of all COTS hardware and software will be covered under the respective product warranties. The Flight Software Development Team will maintain the flight software.

5.0 Product Assurance

This section describes the processes and procedures that will be followed in order to assure that the product developed satisfies the customer's requirements.

5.1 Assumptions and Constraints

It is assumed that all GOTS products employed in the ULDB Flight Software will be ISO 9001 compliant. The supplier of each GOTS product is expected to maintain quality records related to the product. It is assumed that all COTS products will meet or exceed all specifications included in the purchase request.

5.2 Quality Assurance

This section describes the processes and procedures that will be followed in order to assure that the customer receives a quality product.

5.2.1 Control of Non -Conforming Products

Prior to release and acceptance of the system, non-conforming products will be reported using the ULDB Flight Software Request for Change form found on the ULDB Flight Software web page at http://www.wff.nasa.gov/~code584/ULDBFlightSoftware/documentation.html. Following release and acceptance of the system by the customer, changes will be tracked using the Center Level Non-Conformance Reporting (NCR) found at http://scylla.gsfc.nasa.gov/cars/.

Reports of nonconformance will be reviewed, tracked, and maintained by the development team. An assessment of the impact of the nonconformance to the schedule, budget, and delivery of the product will be made by the development team and reported to the customer. The ULDB Flight Software development team will maintain changes made to the system in response to a nonconformance report. Reports of minor nonconformance will be tracked by the PDL via email archival.

The customer will have the authority to use or refuse to use the product in an operational environment.

5.2.2 Corrective and Preventative Action

Errors will be reported using the ULDB Flight Software Request for Change form found on the ULDB Flight Software web page. Reports of nonconformance will be reviewed, tracked, and maintained by the development team. An assessment of the impact of the nonconformance to the schedule, budget, and delivery of the product will be made by the development team and reported to the customer. Implementation of changes will be done according to the priority defined by the ULDB Project management.

All system changes will be verified using Test and Verification Matrix before system release.

5.2.3 Control of Quality Records

The ULDB Flight Software PDL will be both the Quality Records Coordinator and the Quality Records Custodian. A list of the quality records will be linked to the ULDB Flight Software web page at http://www.wff.nasa.gov/~code584/ULDBFlightSoftware/documentation.html.

5.2.4 Control of Documents and Data

The ULDB Flight Software PDL controls all documents generated by the ULDB Flight Software development team.

5.3 Configuration Management

Configuration management procedures will be applied to all components delivered or developed during this effort and will be base-lined as of June 1st, 1999.

Subsequent builds or deliveries will result in incremental versions of the system. All release notices are maintained as part of the system's quality records. NCR's will be documented on ULDB Flight Software release notices with workarounds. Changes to archived or installed software following the initial delivery must be requested using the ULDB Flight Software Request for Change form on the ULDB Flight Software web page at http://www.wff.nasa.gov/~code584/ULDBFlightSoftware/documentation.html. The ULDB Flight Software development team will review all changes. An estimate of the schedule and budget necessary to effect the requested change will be made and presented to the ULDB Project management. All supported documentation and records will be maintained until the system has met its development requirements, at which point this documentation will be turned over to the customers.

5.3.1 Identification and Traceability of Products

A formal release form signed by the ULDB Flight Software development team, the ULDB Flight Software Program Lead, the ULDB System Engineer, and the ULDB Mission and Operations Manager will become a part of the project's quality records. The release form will include an identification of components that comprise the released product as well as any known constraints or restrictions.

5.3.2 Control of Customer Supplied Elements

There are no customer-supplied elements.

6.0 Plan Update History

Version	Date	Description	Affected Pages
1.0	January 20, 1999	Original	All
1.0.1	February 9, 1999	Added Rodney A. Davis as Technical Lead	5
2.0	February 17,1999	Additional sections completed.	All
2.0.1	April 8, 1999	Added signature page.	Signature page
2.0.1	April 8, 1999	Specified approval authority by position.	1
2.0.1	April 8, 1999	Clarified product delivery medium.	3
2.0.1	April 8, 1999	Post delivery maintenance procedure added.	3
2.0.1	April 8, 1999	Added metrics to Section 3.11	9
2.0.1	April 8, 1999	Elaborated on review scheduling.	12
2.0.1	April 8, 1999	Included test software in Section 4.1.4	12
2.0.2	April 27, 1999	Make corrections/changes as noted by ISC Management.	All
3.0	June 28, 1999	References to TDI deleted.	2,5,7,9,10
3.0	June 28, 1999	Reference to budget added in 2.9.1.	3
3.0	June 28, 1999	Section 2.9.2 clarified as to the flight computer and flight subsystems making up the test bed.	3
3.0	June 28, 1999	Sections 4.1.1.1 and 4.1.1.2 modified to correlate more closely to the schedule.	9
3.0	June 28, 1999	SBS Avionics PASS-1000 1553B software simulator test software and Wind River Systems WindView software tools included in Section 4.1.4.	11
4.0	February 18, 2000	Update to ISC PD, Rev. D (9/1/99)	All